METHODOLOGY TO ALIGN FUNCTIONAL PLANS FOCUSED ON AN INTERNATIONAL BEVERAGE PACKAGING COMPANY

ABSTRACT

One of the companies' challenges is to develop the strategic fit between the supply chain and its functional plans: marketing, operations, human resources, and finances. This case focuses on a company that produces polyethylene terephthalate packaging for the beverage industry, with more than 15 years in the Latin-American market. The main problem was identified through the best practices of different methodologies: the cause-effect tree diagram, the value stream mapping, material requirement planning, sales and operations and integrated business planning. This problem has been restricted within the inventory management, which has the longest delivery and response time. Finally, the company improved inventory turnover, enhanced the manufacturing quality, eliminated the "island effect" and generated the whole impact in the value network.

Keywords: PET, supply chain management, value stream mapping, optimization

INTRODUCTION

The polyethylene terephthalate (PET) preforms packaging for the beverage industry is based on cost and a production volume market with a small and seasonal growth rate. The company, in this case, has production plants in more than 40 countries. Since 1998, the filial in Peru has had a market share of 27%, which is equivalent to $ 94 million/year of sales. Its supply chain strategy is "push" with a structure of 78% in annual contracts and a monthly forecasted demand, using the moving average mean-variance adjustment to stabilize the orders. On the other hand, the spot sales' strategy is "pull", with a structure of 22% immediate orders, with a monthly security inventory, due to the market trends and variability. These spot sales generate an inter-functional lag focused on their objectives, known as the "silo effect", instead of maximizing the profits; it increases inventory costs, transportation and procurement overrun costs and unpredicted responsiveness.

In this study, the methodology was based on the following steps: define goals and objectives; identify the main problems; analyze and evaluate the initiatives, and implement the action plan. The proposal considered the logistics drivers (Chopra, 2020) and inventory management indicators (Frazelle, 2018). During the evaluation process, we used the Value Stream Mapping (VSM) (Martin & Osterling, 2014) to identify the main problem, which was the delay within the inventory management. We employed the cause-effect tree diagram to determine the main effects and causes, which support the integration of company planning. Then, we proposed the action plan considering the best practices of three methodologies: the Material Requirement Planning (MRP) (Ptak & Smith, 2013) (Wilson, 2016) (Kortabarria et al., 2018), Sales and Operations Planning (S&OP) (Wallace & Stahl, 2014) and Integrated Business Planning (IBP) (Palmatier & Crum, 2013) for the strategic objectives of the company: improving the inventory management, maximizing their profits and increasing the customer service level.

A company's supply chain is a network, with the following process: the acquisition of raw materials, the transformation into intermediate and finished products, and the distribution of the final goods (Capgemi & The Consumer Goods Forum, 2015). The flows across the entities (factory, distributor, wholesales, retailer, and customer) include goods, money, information, among others (Harrison, 2007) (Christopher, 2016). Inaccurate information generates inefficiencies of the production process, under and overcapacity of the plant, uncertainty of the

inventory, and variability of transportation costs (Qrunfleh & Tarafdar, 2014). If the organization has adequate information it could be more competitive and reliable to its customers. For this reason, we proposed the strategic alignment between its competitive strategy and its functional plans of marketing and operations (David et al., 2017), considering the customer requirements and the production plant capability (Perez-Franco, 2016). The alignment of the marketing plan is focused on understanding the demand characteristics: lot size, response time, product variety, service level, product price, and innovation rate (Wood, 2014). The alignment of the operation plan is focused on understanding the supply characteristics: supply chain capabilities, response capacity, and cost-efficiency (Perez-Franco & Phadnis, 2018).

THEORETHICAL FRAMEWORK

We used the VSM to know the time associated with the activities and the processes in the organization supply chain (Martin & Osterling, 2014)(Venkataraman et al., 2014). This is an essential methodology used to formulate improvement plans, to evaluate the actual processes (known as "As Is") and to improve them ("To Be") (Perez-Franco et al., 2016). Its sets are: the activities and task time or the expected response time, to identify where the processes are outside the limits (Anderson & Gerbing, 1988) (Forno et al., 2014). This methodology considers the overall actions that are needed to deliver material through the value chain (Rohac & Januska, 2015). In this case, it has been used to determine the bottlenecks that delay the flow of the main product (PET preform) and its distribution to the final customer.

Moreover, we applied the cause-effect tree diagram to identify the main problems and to formulate clear and manageable objectives, as well as strategies. This diagram represents the problem focused on what is happening (main problem), why it is happening (causes) and what is causing it (effects) (Ministerio de Economía y Finanzas, 2019). The company designs its flow of components considering the demand variability and using the inventory management methods (Damayanti et al., 2019). However, when the company has a seasonal high demand, these methods are unmanageable. In such environment, they manufacture products with a predictable demand during the low season to avoid the inventory accumulation during high demand, achieving a balance

between the efficiency and responsiveness of the supply chain (Christopher et al., 2006) (Reichhart & Holweg, 2007).

Additionally, we implemented the MRP, which explains the production planning system and inventory management during the manufacturing processes (Kortabarria et al., 2018). It focuses on several questions such as: what, how much and how; all the components needed for the finished products (Morecroft, 1983) (Ptak & Smith, 2013). It also determines the material requirements with an effective and disciplined focus for the PET perform production (Pekarcíková et al., 2019). Finally, the IBP connects the functional plans to the corporate strategy performance (see Figure 1), with an effective balance between the supply and the demand (Palmatier & Crum, 2013).

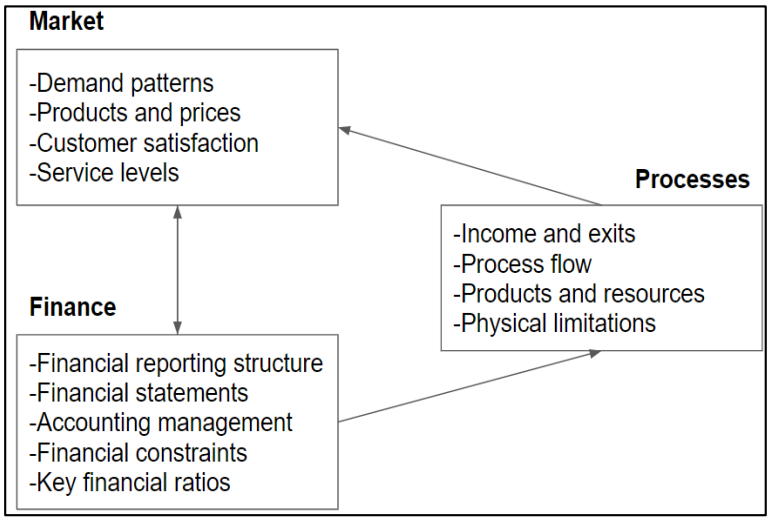

Figure 1: IBP components – Own elaboration

The overall view of the supply chain presents a wide range of opportunities that can be achieved in the organization; improving its efficiency, controlling its processes and costs (Simchi-Levi et al., 2014) (Pereira et al., 2014), as well as enhancing cost-effectiveness and product delivery capacity (Laudon & Laudon, 2020). Hence, to identify the main improvement, it is essential to recognize the current situation (AS IS), which is structured in five processes: the purchasing and acquisition management, the production management, the stock management, the transportation management and the demand management (Simchi-Levi, 2014). In this case, the "Silo effect" presents and indicates that each process is performed in isolation, focused on its particular

objectives (Christopher, 2016), without taking into account the system's competitiveness (see Figure 2).

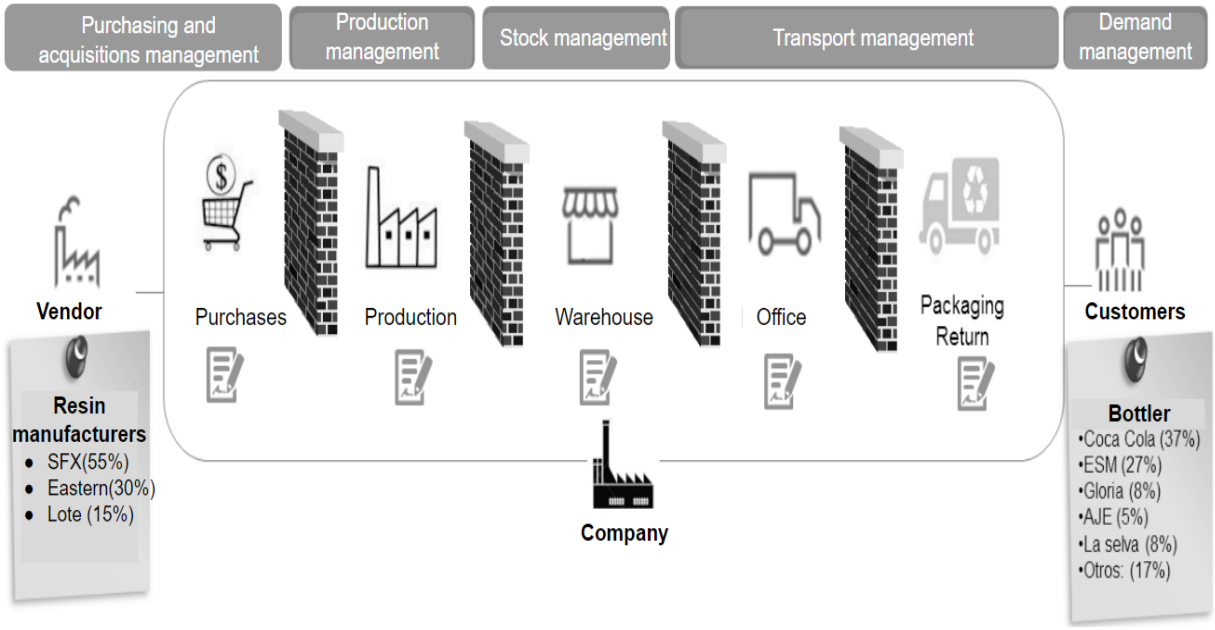

Figure 2: Company supply chain process – Own elaboration

METHODOLOGY

In this section, we describe the steps to identify the main problem. Then, we formulate the improvement project, and finally, we compare the current (AS IS) and future (TO BE) situation.

The first step was identifying the main problem, carrying out the VSM and the bottleneck time histogram. Three critical problems were identified: the inventory management, the storage and the packaging of the preforms and the resin dryer (see Figures 3 and 4).

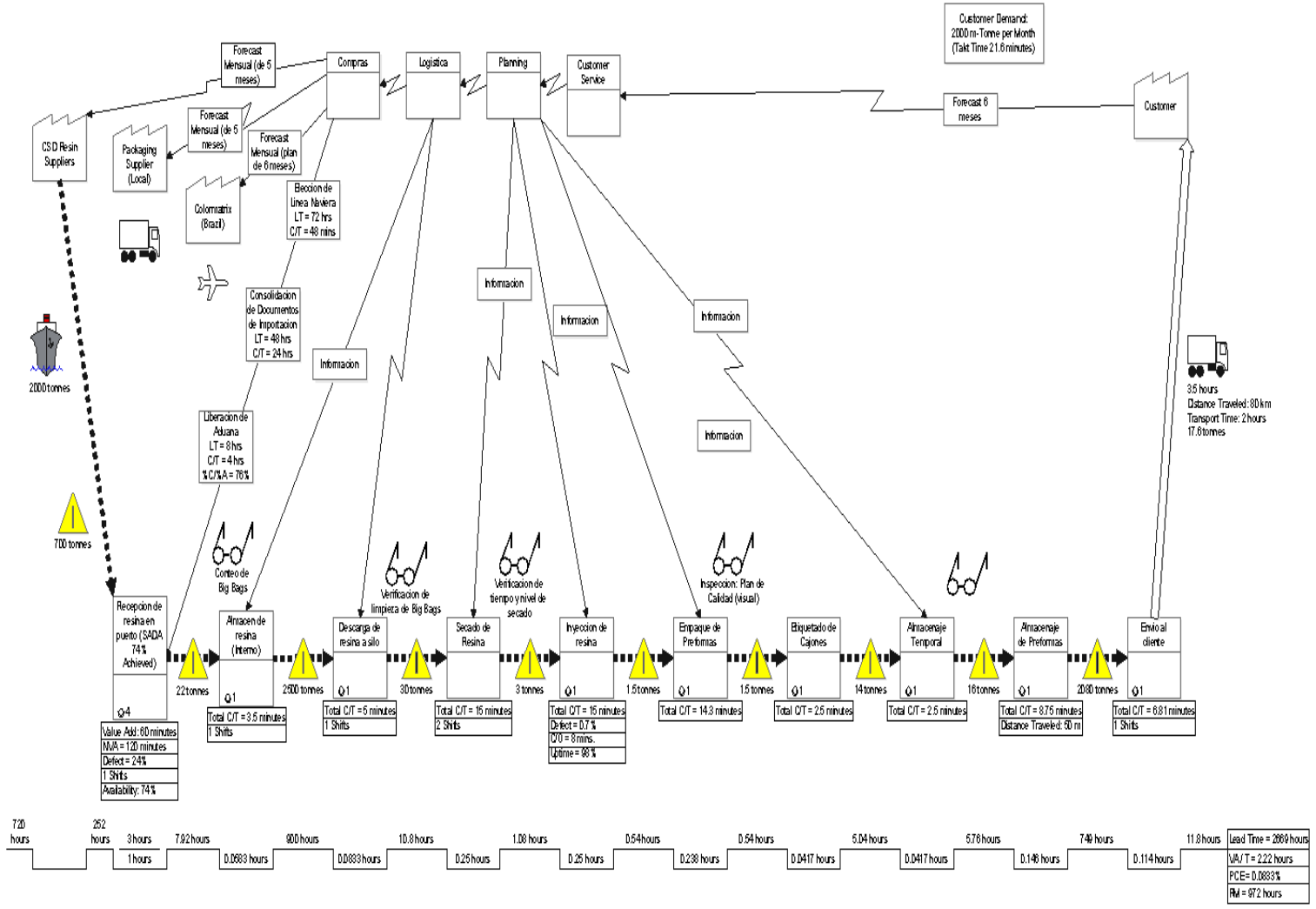

Figure 3: Value stream mapping– Own elaboration

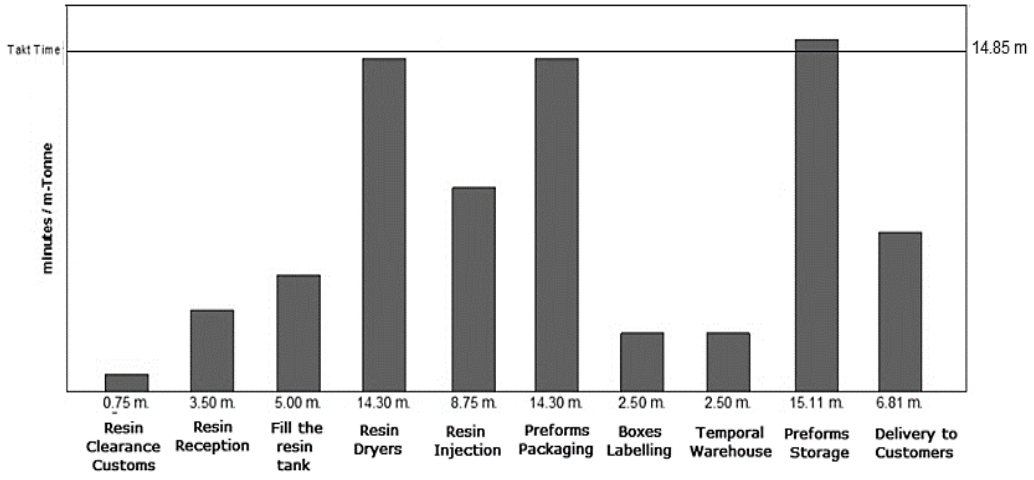

Figure 4: Bottlenecks time histogram – Own elaboration based on (Martin & Osterling, 2014)

The second step was recognizing the causes and effects of the main problem. According to this analysis, the silo effect causes inventory management problems, which lead to a low response capacity (see Figure 5).

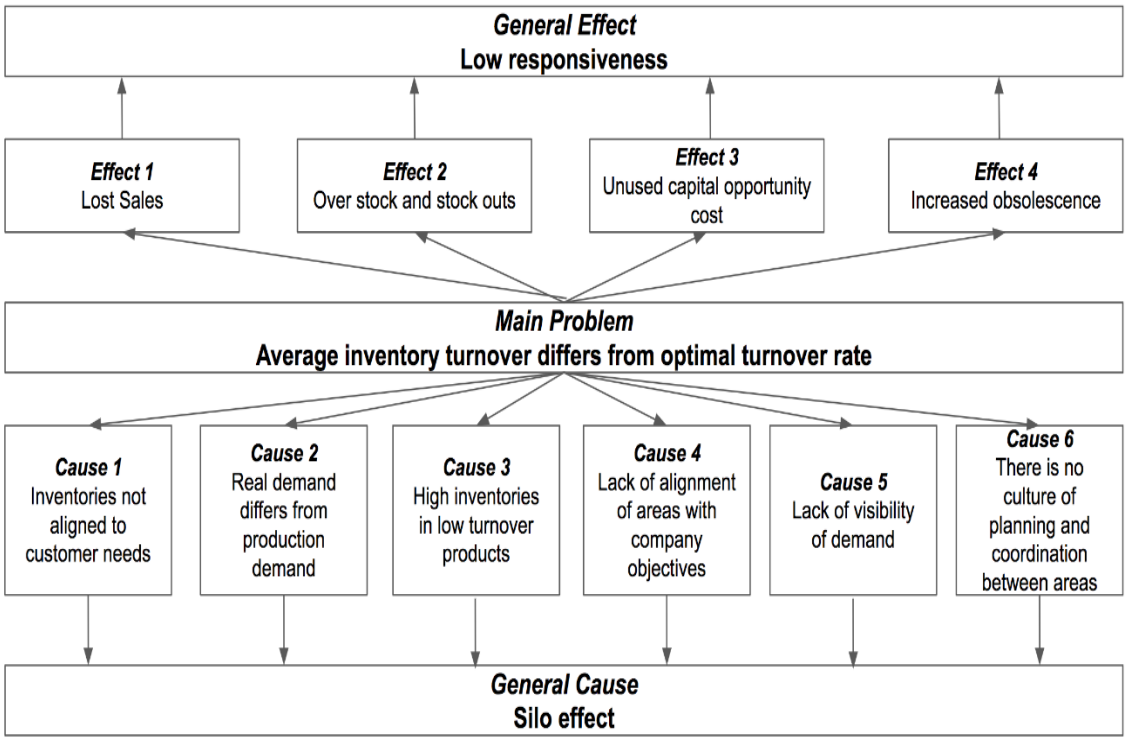

Figure 5: Cause-effect diagram – Based on (Ministerio de Economía y Finanzas, 2019)

The third step was diagnosing, analyzing and presenting the improvement proposal as well as the parameters evaluated. The MRP includes the data master, the demand planning and the inventory control; the S&OP aligns the functional areas of sales and operations considering the internal processes and the decision-making coordination, and finally, the IBP considers an inventory turnover rate greater than 6.85 times per year and an inventory coverage equal to 1.75 months; controlling the preforms aging or obsolescence, the inventory cost and the cost overflow of sales and turnover (see Figure 6).

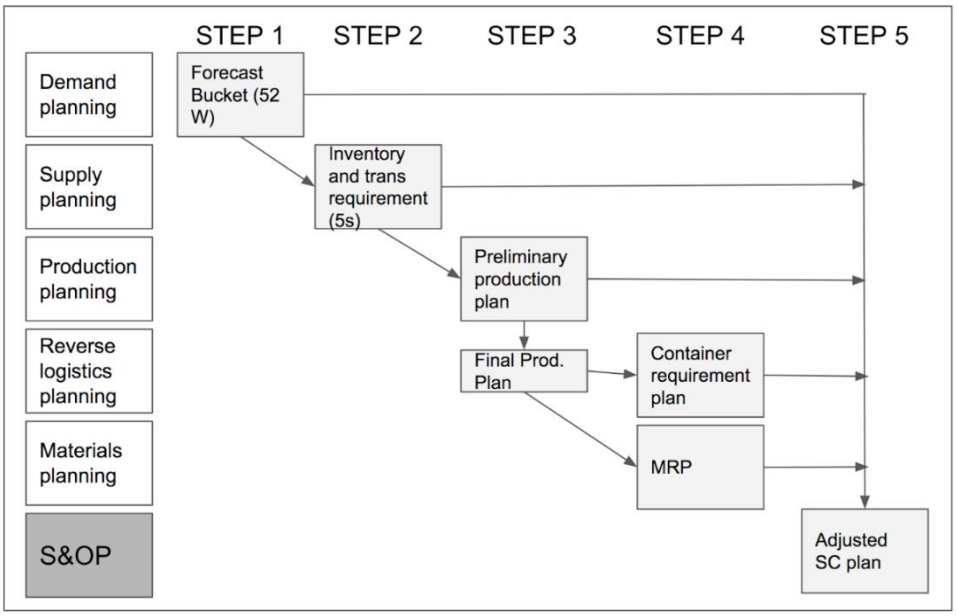

Figure 6: Organization´s steps and responsibilities – Based on Muso (2014)

The fourth step was the cost-benefit analysis, considering three cost components: software and hardware, system configuration and training (Frazelle, 2018). With the project prioritization matrix, we concluded that the integration of the S&OP and the IBP's best practices was the most adequate policy to achieve integrated planning, eliminate the silo effect, minimize the functional cost and generate an impact on the organization with inter-functional collaborations.

RESULTS

The stock keeping units (SKU) present an annual growth rate of 5% and seasonal consumption, which increases by 20% during the summer; in this case we selected twenty-two (22) SKUs. Therefore, sales planning could be carried out by applying the safety stock methodology, considering a desired service level.

The purchase management controls the raw materials supply, using the company´s enterprise resource planning (ERP), which manages manual purchase orders and suppliers' payments. The PET resin purchases do not present high cost overrun for its transportation mode, by cargo ships. The packaging cost overrun is around USD 8,000 per year due to the lack of consolidation. The PET resin purchasing is notified three months in advance. This purchase is carried out at regional level, through global brokers. The transit time is four weeks, considering two weeks of preparation at the factory and two weeks of financial and administrative processes. Finally, it takes one week to release the cargo at the Peruvian Customs. On the other hand, the packaging purchasing includes cardboard boxes which contain manufactured preforms and accessories, such as straps, staples, stretch wraps and pallets to secure and transport the products. The local senior buyer is responsible for purchasing these materials locally and the average delivery time is fifteen days. Besides, the pallets average inventory is recovered from customers as free transfers, reducing the operation cost.

The operations management controls the production capacities to satisfy the demand and estimates the raw material requirements to ensure the purchasing operations. It also manages the inventory, which is focused on optimizing the product storage, space planning, product security, economic order batches, among others. The company rents third-party warehouses, which generate additional costs. The integrated implementation had to be evaluated, considering the master production schedule and its performance, the work breakdown structure (WBS), and the risk matrix (see Table 1 and Figure 7). With this entire process, it is expected to achieve operative optimization. Table 2 shows the activities and the implementation.

The transport management controls the product flows, considering 78% of finished goods by annual contracts and 22% by spot orders in all the country; taking into account, the raw materials and intermediate products through the suppliers, factory, distribution centers, wholesalers and customers.

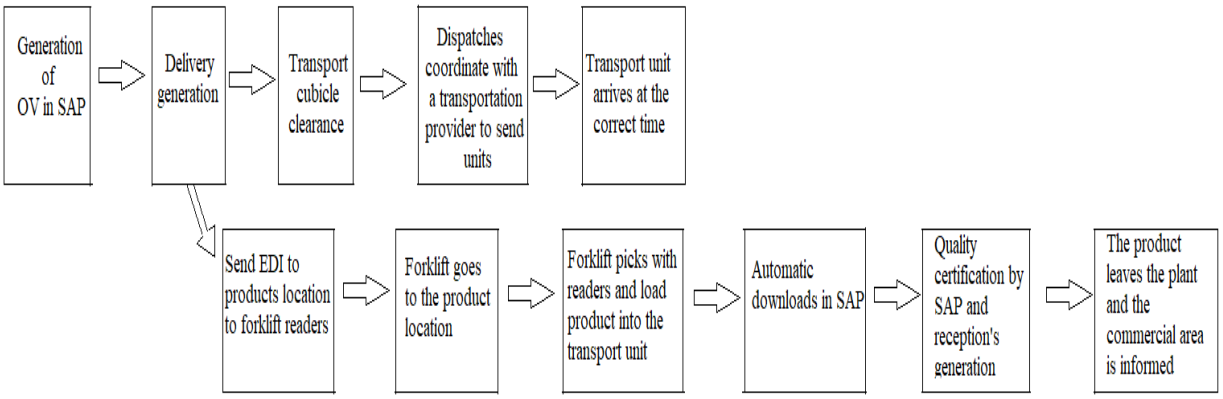

Figure 7: Flow of attention orders. Source: Own elaboration.

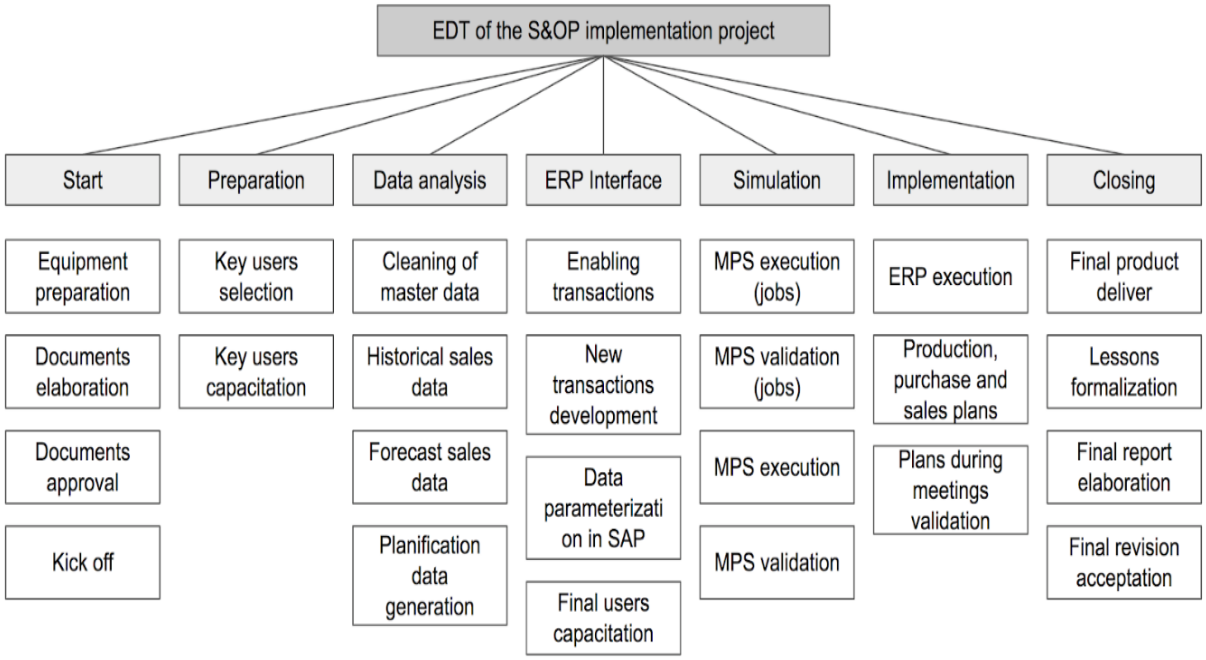

Figure 8: EDT of the S&OP implementation project– Based on (Wallace & Stahl, 2014)

Table 1: Implementation risk matrix

Risk Code	Risk Factors	Total Lost	Risk Controllers	Risk probability	Risk Controllers	Impact probability	Expected loss
R002	Non-compliance with the demand loading dates in SAP by the commercial area.	$10,000.00	Have the contingency personnel to replace the people who are part of the project.	35%	Analysis and restructuring of roles and tasks.	80%	$2,800
R001	The level of commitment of the heads of areas is poor.	$14,000.00	Proper handling of Change Management, Collaboration of the GGHH area for message transmission.	20%	Measurement of the acceptance and useof the new system, generating incentive systems.	70%	$1,960
R007	Lack of information on the S&OP model.	$13,000.00	Create an aggressive communications plan to ensure effective team interaction.	15%	Analysis and restructuring of roles and tasks.	60%	$1,170
R005	Change resistance	$23,000.00	Reinforce message of participation by promoters.	10%	Generation of teamwork and goals together, with incentive programs.	50%	$1,150
R004	The benefit of the project is not well defined.	$15,000.00	Ensure the necessary resources for the development of project requirements.	5%	Continuous monitoring of tasks, implementation of measurement parameters.	60%	$450
R003	Business processes, procedures, and policies require a substantial change.	$13,000.00	Plan activities with the CONSULTANT in a timely manner and have regular follow-up meetings.	10%	Continuous monitoring of tasks, implementation of measurement parameters.	30%	$390
R006	To attend to daily operations, project activities are not attended	$5,000.00	Request user participation in planning meetings. Also request support from the project sponsors to generate enthusiasm.	5%	Inefficient personnel change	30%	$75

Table 2: Redesign the activities

Activities	Current situation	S&OP Situation
1.Demand planning	Centralized, manual and by type of material	Automatic and generic
2.Demand vs. inventory comparison	Manual	Automatic
3.Production planning	Manual	Automatic
4.Mold and color changes	Frequent and manual	Optimized and automatic
5.Procurement planning	Manual	Automatic
6.Inventory planning	Inventory not associated with turnover rate	Inventory associated with turnover rate
7.Distribution and dispatch	Reactive	Planned

Likewise, considering the economic-financial impact, the cost-benefit analysis was performed in three possible scenarios: optimistic (5% probability); average (90% probability), and pessimistic (5% probability). They were calculated by adding +/- 5% to the average scenario. Then, the internal rate of return (IRR) would be 67.64% and the profit before interest and tax (PBIT) would increase by 9.04% for the next year.

This strategic adjustment will demonstrate how the improvement proposal is aligned with the competitive strategy and its functional plans (Perez-Franco et al., 2016) (David et al., 2017); considering the company's objective is to increase the PBIT by 5% and the supply chain strategy is to focus on responsiveness to customers.

CONCLUDING REMARKS

The company must align their functional plans with its corporate strategy. These plans must consider their strategies, products and services, as well as their competitive priority: cost, quality, time and prices for future directions (Simchi-Levi & Wei, 2012) (Chopra, 2020); in this case, a company dedicated to the manufacture of PET packaging for beverage industries. To align inventory management objectives with corporate goals, all cross-functional and cross-organizational relationships must be considered.

In the Peruvian market, the PET packaging profit has stagnated, the consumption statistics show a decrease in soft drinks and an increase in mineral water. Therefore, through this project we will: eliminate the "island effect", increase profit to USD 8.5 million, obtain an IRR of 67% and a PBIT of 9.5% and reduce the response capacity between 65 to 90 days.

On the other hand, it was essential to identify bottlenecks and propose solutions that lead to improve the company's value chain. Also, the planning area must integrate the sales, production, and supply plans, as well as their policies, indicators, and objectives. Likewise, the project has a social impact, since it reduces 200 million grams of CO_2 footprint and the waste or scrap due to obsolescence.

Finally, this project mainly optimizes inventory management by maximizing the supply chain coordination, improving the communication between sales, logistics and operations, aligning the coverage of the preform inventory, reducing: the preforms obsolescence, the inventory cost, the lost sales and the mold changes, and automating manual processes.

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